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EVALUATION OF THE USALWL WEATHER KIT

by

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Biological Sciences Branch

May 1974

Final Report

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

In response to a field requirement delineated by the 2nd Armored Cavalry Regiment, a small, compact, lightweight weather kit that can be carried on an individual's belt was developed. The kit can be used by untrained personnel after brief familiarization with the operating instructions. Kits were supplied to a number of potential user units for field evaluation. Although incomplete at the present time, the evaluation results indicate a high degree of user acceptance.

AD-780745

PREFACE

The work reported here was performed under LWL Task 04-B-74, USALWL Weather Kit. The author wishes to acknowledge the assistance of Mr. Thomas Jankowski, a student who was assigned to the Biological Sciences Branch as a temporary summer employee, and the cooperation of LTC William Sheldon, Military Operations Division, USALWL, in arranging for field evaluations by various military units and for assisting in the preparation of a Draft Proposed Required Operational Capability.

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INTRODUCTION

Army tactical units frequently require specific knowledge of localized weather conditions for planning and conducting operations. Such information may not be provided in sufficient detail by standard weather service reports. During a USALWL liaison visit to USAREUR in 1972 this problem was mentioned by personnel of the 2d Armored Cavalry Regiment who stated that the unit did not have equipment needed to obtain such information. It was determined at that time this need might be met by provision of a simple, lightweight observational capability for use by personnel who are not trained meteorological observers. The concept that was then formulated envisioned a weather data collection set for field issue to individual soldiers.

An immediate development effort was initiated by LWL to provide a prototype weather data collection set for field evaluation. Ten sets were assembled and delivered to the 2d ACR.

In a subsequent liaison visit to USA Alaska, a similar weather data collection requirement was discussed and interest was expressed in the LWL development. As a result, eight additional sets were assembled and delivered to Hq, USARAL, Ft Richardson, Alaska. As information concerning the LWL development was disseminated, other organizations asked for sets to test and evaluate. Ultimately, prototype weather data collection sets were made available in the quantities indicated to each of the following:

1. Ten sets to the USA Institute for Military Assistance, Ft Bragg, North Carolina.

2. Two sets to the USA Combined Arms Combat Development Activity (PROV), Ft Leavenworth, Kansas.

3. Ten sets to the R&D Coordinator, US Embassy, S. Vietnam.

4. Five sets to the Electronics Command, Ft Monmouth, New Jersey.

5. One set to the US Marine Corps Development Center, Marine Corps Development and Education Command, Quantico, Virginia.

KIT COMPONENTS

The components of the USALWL Weather Kit, with the exception of the barometer (altimeter), are shown in Figure 1. Figure 2 shows the components as they are normally packed in the carrying case. The barometer is shown in Figure 3; it is carried in a pocket attached to the closing flap of the carrying case. The weather kit enables the user to measure the following weather parameters:

Relative humidity (over a range from +30°F to +120°F with the sling psychrometer)

Dew point.

Ambient temperature (from -25°F to +120°F $\pm$ .5°)

Atmospheric pressure ($\pm$ .5 mb)

Wind speed (0 to 60 mph $\pm$ 2 mph)

Wind direction (360° $\pm$ 5°)

Amount of precipitation

Rain - 3.5 inches $\pm$ .1 inch

Snow - 8 inches using base of rain gauge

Estimation of cloud base height

The set includes the following components; stock number, model number, source of supply and unit cost, where applicable are shown:

1. Carrying case, belt weather kit case. Forest. Serv. Spec 5100-45a, 8465-521-3057, $3.25.

2. Sling Psychrometer, carrying case. Type V Int. Fed Spec GG-P-00725, 6685-826-1662, $7.40.

3. Thermometer, Pocket, Cat. No. 9329-B35, -30°F to +120°F, 5-3/4" long with anodized aluminum case. Arthur H. Thomas, P. O. Box 779, Philadelphia, Pennsylvania, $3.50.

4. Barometer/altimeter, Engineers, BM 40-M (Meter Scale), Weathermeasure Corp., Box 41256, Sacramento, California 95841, $69.00.

5. Compass, Silva Explorer - Type 1, Silva, Inc., Highway 39 North, LaPorte, Indiana 46350, $7.35.

6. Wind Director Indicator, seven inch nylon string with attached Cork xxx, size 9, epoxied to the compass.

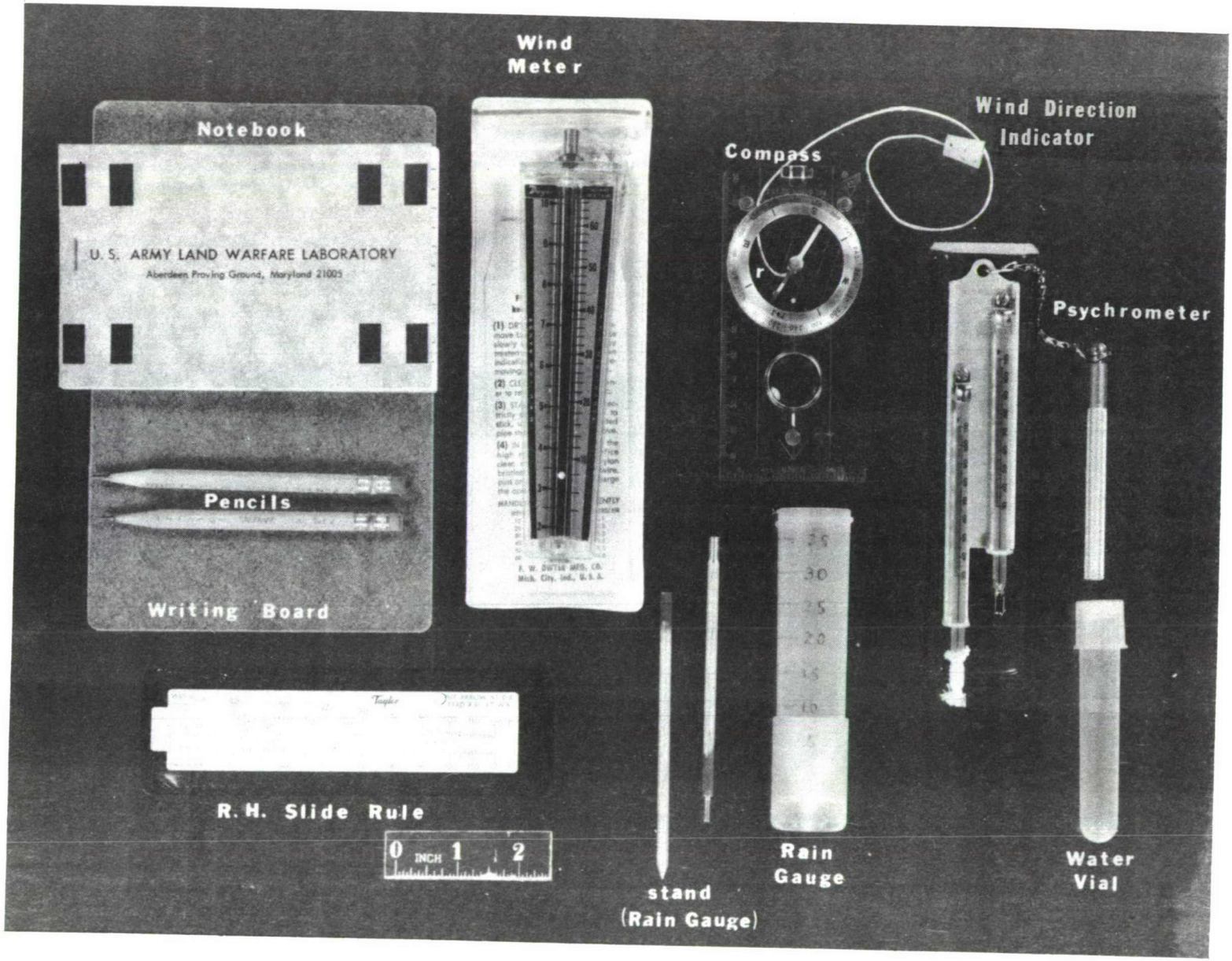

Figure 1. Components of LWL Weather Kit.

Figure 2. Weather kit components stored in carrying case.

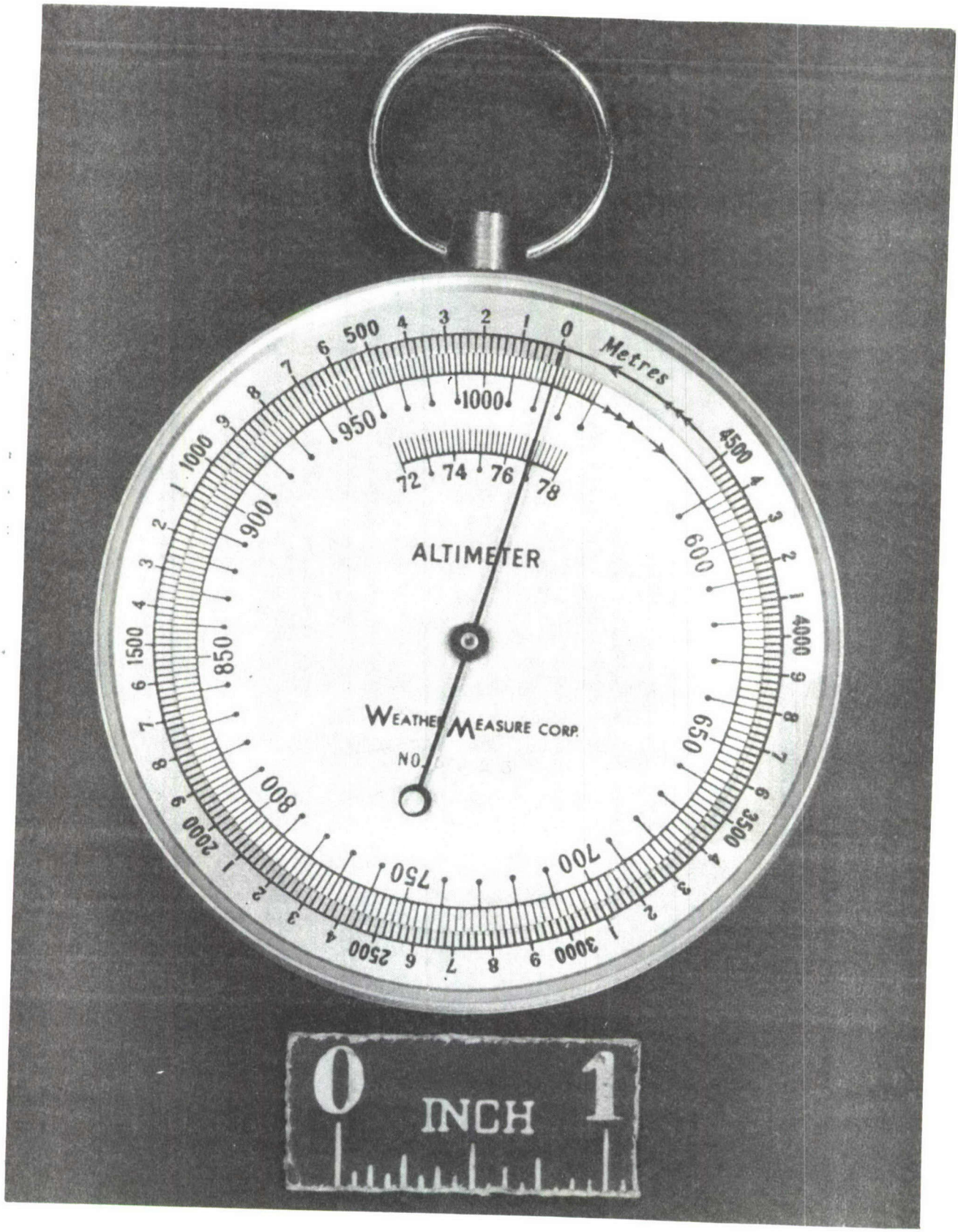

Figure 3. Barometer (altimeter) provided with the LWL weather kit.

7. Wind Speed Meter, Air Velocity, For. Serv. Spec 5100-454, 6680-833-7010, $3.85.

8. Conversion Slide Rule, Hygrorule, Model 1326, w/carrying case, Taylor Instrument Co., Arden, North Carolina 28704, $3.80.

9. Rain Gauge, Tube, Conical Tube, Cat. No. 14-432-22, Fisher Scientific Co., 711 Forbes Avenue, Pittsburgh, Pennsylvania 15219, $0.15.

10. Weather Data Notebook (fabricated at USALWL).

11. Water vial, Tube, Falcon Disposable Culture, Cat. No. 14-959-11B, Fisher Scientific Co., 711 Forbes Avenue, Pittsburgh, Pennsylvania 15219, $0.08.

12. Writing Board, 8-1/4" 1 x 5-1/2" w x 1/8" thick masonite.

13. Instruction Manual.

14. Writing Pen/Pencil.

TESTING

All components, whether commercially available or specially fabricated, were inspected for completeness. They were then calibrated and tested for proper operation. A rain gauge was fabricated at USALWL and calibrated for accuracy with a standard US Weather Bureau rain gauge.* The wind direction indicator was tested for proper operation. Although climatic and other environmental stress tests were not performed, evaluating units did not report any problems in this area.

The parachute-delivery capability of the kit was tested. The equipment was found to be suitable for parachute delivery when properly packed in an aviator's kit bag, rucksack, parachutist's adjustable equipment bag, or individual weapons and equipment container.

Kits were issued to four (4) non-commissioned officers with little or no knowledge of meteorology. With only the operator's instruction manual as a guide, each man, within an average of twenty (20) minutes, was able to operate the set efficiently.

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*The rain gauge, shown in Figure 4, was fabricated using a Fisher Scientific Co. Conical Tube, Cat. No. 14-432-22, as the collecting tube. The base was fabricated from a 1-1/8" diameter x 1-3/4" long Lucite tube, hollowed to a depth of 1-1/4" to admit the conical base of the collecting tube. The stand was fabricated from a 9-inch long x 3/16-inch diameter aluminum rod and scored every inch to facilitate measuring of snow depth. Figure 5 illustrates the correct method of emplacement of the rain gauge in the field.

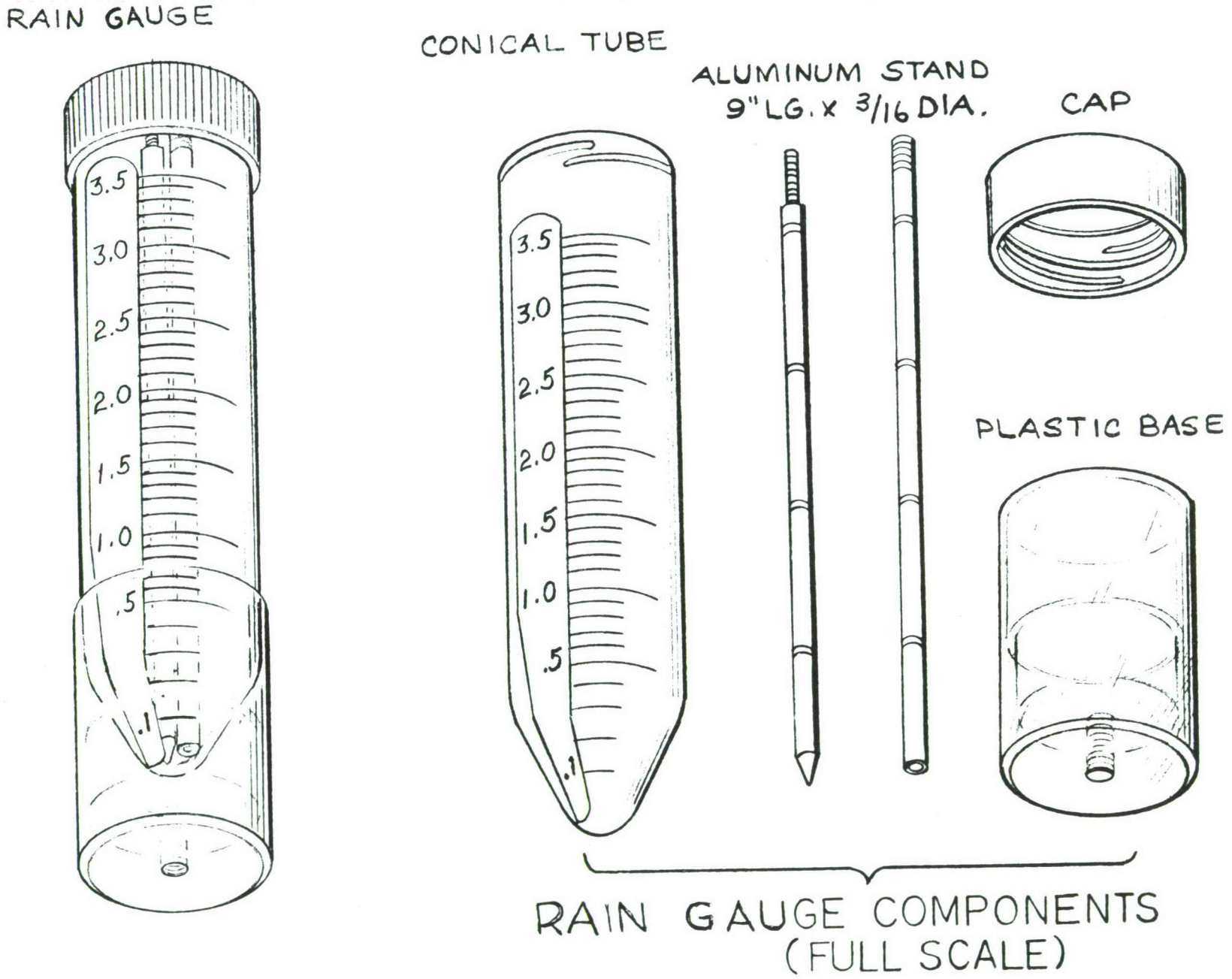

Figure 4. Rain gauge. Components disassembled and assembled.

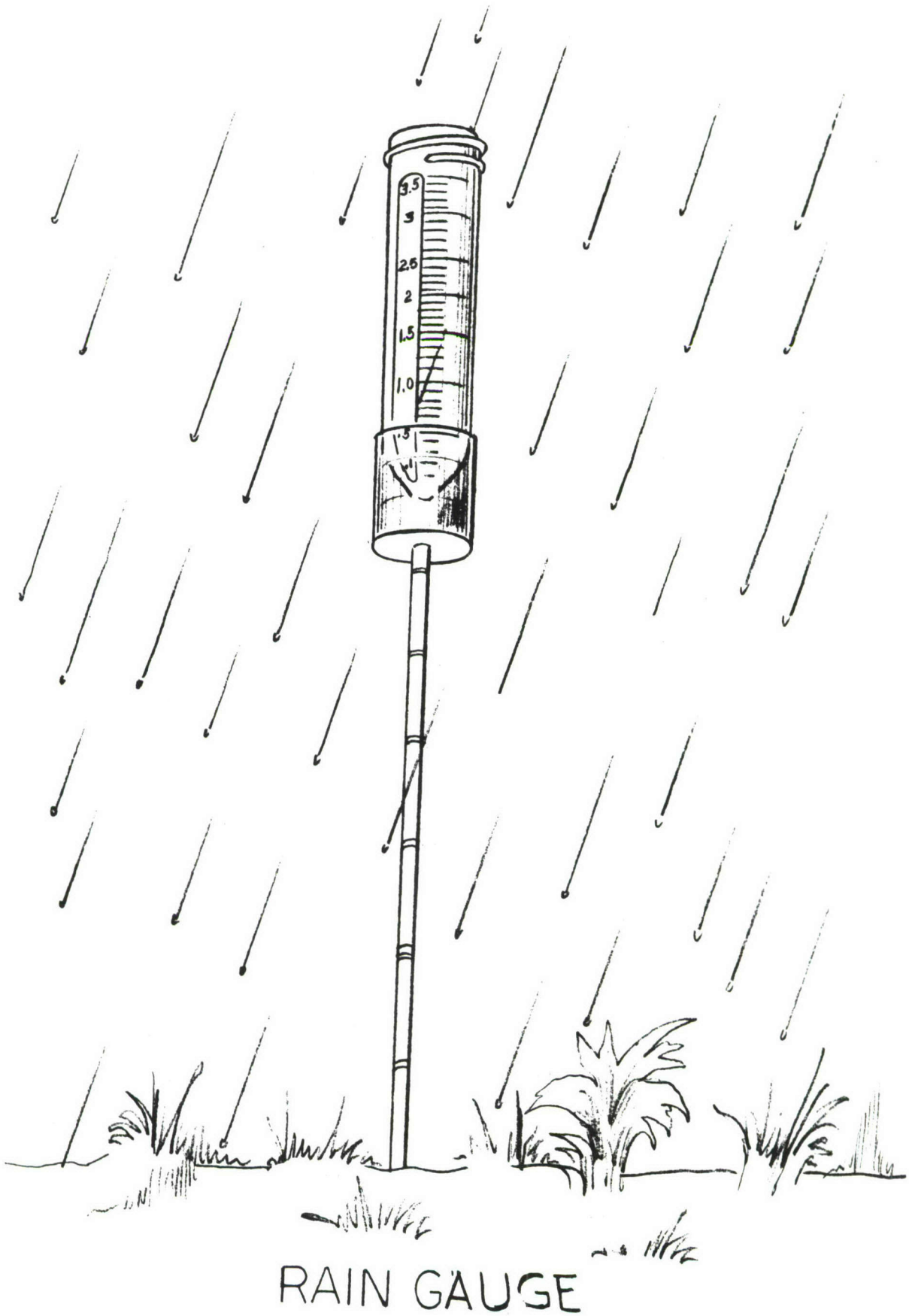

Figure 5. Method of rain gauge emplacement.

FIELD EVALUATION

Each organization that received weather kits to evaluate was also furnished with a proposed evaluation plan, including an operator's questionnaire, and an operating and maintenance manual (see Appendix A).

To date, official, documented responses pertaining to the results of the evaluations have been received only from the 2nd Armored Cavalry Regiment (Appendix B) and from the US Marine Corps Development and Education Command (Appendix C). A limited amount of informal feedback has been received from other evaluating units.

In general, the responses by evaluating units indicate a high degree of acceptance of the kit. Some deficiencies in the kit were noted. The 2nd ACR indicated that the sling psychrometer is not useful at temperatures under 30°F. A standard sling psychrometer cannot be used under 32°F; to measure relative humidity at temperatures below the freezing point of water, it is necessary to use an instrument such as an Assmann psychrometer which measures the rate of ice crystal formation as a function of relative humidity. The cost of an Assmann psychrometer, however, is prohibitive and it is unsuited for inclusion in a small, belt-carried kit. It was also noted in the 2nd ACR report that the LWL kit includes no equipment to measure cloud base height. Cloud base height, however, can be fairly closely calculated by applying a standard multiplier factor to the difference between wet and dry bulb thermometer readings (Appendix A). The method is explained in the operating and maintenance manual supplied with the weather kit.

Finally, the 2nd ACR report is critical of the notebook supplied with the kit for recording observations. In spite of this comment, it is thought that the notebook is probably adequate in most circumstances. If a user should require a more elaborate form, Air Force standard weather data forms are available.

The comment received from the Marine Corps indicates that the LWL weather kit would appear to have value and utility to an isolated unit/person, such as a coast-watcher, a deep observation post. This comment suggests that uses in addition to that originally delineated by the 2nd ACR might well be found for this kit as its availability and inherent versatility became better known.

PARENT AGENCY ASSIGNMENT

The US Army Materiel Command designated the USA Electronics Command, Ft Monmouth, New Jersey, as parent agency for the LWL Weather Kit.

CONCLUSION

The LWL Weather Kit provides a needed, useful weather observation capability for small tactical units, deep observation posts, coast watchers, etc.

RECOMMENDATION

Further effort should be directed to type classifying the LWL Weather Kit.

APPENDIX A

1. Proposed Evaluation Plan, Weather Data Collection Set

2. Evaluation of the USALWL Weather Kit. Questionnaire.

3. Operating & Maintenance Manual.
   Lightweight Weather Data Collection Kit.

APPENDIX A3

OPERATING & MAINTENANCE MANUAL

LIGHTWEIGHT WEATHER DATA COLLECTION KIT

June 1973

U. S. ARMY LAND WARFARE LABORATORY
Aberdeen Proving Ground, Maryland 21005

TABLE OF CONTENTS

SECTION I. INTRODUCTION

1.1. Scope. This manual contains the description and operating procedures for the Lightweight Weather Data Collection Set.

1.2 Purpose. The purpose of this set is to provide units in the field with the capability of measuring basic surface weather parameters. The data collected can be applied to local tactical operations and reported to other agencies for forecasting purposes.

SECTION II. DESCRIPTION AND DATA

2.1. General. The Weather Data Collection Kit is a simple lightweight kit designed for use by personnel who are not trained meteorological observers. The kit includes equipment to measure ambient temperature, dew point, barometric pressure, relative humidity, wind speed, wind direction, and amount of precipitation. The individual components are packaged in a carrying case. The set weighs 1.75 lbs.

2.2. Carrying Case. The carrying case is made from water resistant fabric and is divided into pockets for the various components. It has a top flap which can be fastened to the front with two snap fasteners to prevent loss and damage of components while transporting, and to provide protection from the weather.

2.3. Sling Psychrometer. The sling psychrometer is used to measure relative humidity and dew point. It will measure the relative humidity over a temperature range of $30^{\circ}F$ to $110^{\circ}F$, accurate to 2.0 percent and dew point over the same temperature range, accurate to $\pm$ $.5^{\circ}F$. Using the dry bulb thermometer only, the ambient temperature can be measured over a range of $30^{\circ}F$ to $110^{\circ}F$ accurate to $\pm$ $.5^{\circ}F$.

2.4. Thermometer. The thermometer measures ambient temperature over a range of -25°F to +120°F ± .5°F. It is provided with a metal carrying case.

2.5. Wind Velocity Meter. The meter has a high and low range and will measure the wind speed from 2 to 65 miles per hour, accurate to ± 2 miles per hour.

2.6. Barometer/Altimeter. The barometer/altimeter is a pocket-sized instrument housed in a rust-free case. It is used to measure atmospheric pressure and to determine the observer's altitude (elevation). The barametric pressure scale (fixed dial) measures from 550 to 1050 millibars in 2 millibar divisions. The altimeter scale (movable scale)is in 20-meter divisions from 0 to 4500 meters. A small key is provided for adjusting the pointer if this is necessary (see paragraphs 3.1. and 4.9.).

2.7. Wind Direction Indicator. This device is a transparent commercial compass modified so that the wind direction can be measured accurate to ± 5°.

2.8. Rain Gauge. The rain gauge consists of a graduated plastic cylinder providing the capability of measuring rainfall up to 3.5 inches, accurate to ± .1 inch. The jointed standard for the rain gauge is 8 inches long, and can be used to measure snow fall. The capability for measuring approximately 13 inches of snow fall is provided by the rain gauge and the standard.

2.9. Conversion Slide Rule. The conversion slide rule is used to determine relative humidity from wet and dry bulb thermometer readings.

2.10. Water Vial. The water vial provides a convenient means of carrying water for use with the wet bulb thermometer.

2.11. Weather Data Notebook. The weather data notebook contains formats to assist the observer in recording data. It is made from water resistant paper.

2.12. Writing Board. The writing board provides a convenient general purpose writing surface.

SECTION III. OPERATING INSTRUCTIONS

3.1. General. The value of weather observations is only as good as the care with which they are made. Close adherence to the prescribed procedures will provide usable weather data. When time permits, the measurement of each parameter should be repeated to obtain improved reliability.

3.2. Ambient Temperature. A thermometer (contained in a metal case) is provided for measuring ambient temperature. Unscrew the thermometer from its carrying case and hang or hold it for one minute away from heat sources such as vehicle engines, etc., and out of direct sunlight. Carefully read the thermometer without breathing on it or touching the bulb (the glass-inclosed mercury reservoir). Record the ambient temperature under "Temp. Dry" in the weather data notebook. Return the thermometer to its metal carrying case when not in use.

3.3. Dew Point. The wet bulb thermometer (the one with the gauze sleeve) of the sling psychrometer is used to measure the dew point. Soak the gauze on the thermometer in enough water from the water vial to insure that the gauze is saturated. Hold the psychrometer by the handle and whirl it at waist height for at least one minute. Take care to stand clear of any obstructions to avoid breaking the psychrometer. At the end of this time, read the temperature to the nearest degree. Record this reading in the notebook under "Temp. Wet" and "Temp. DP." Wet the gauze sleeve and whirl the psychrometer prior to each reading.

3.4. Relative Humidity. Relative humidity is obtained from the dry and wet bulb temperatures using the conversion slide rule. Following the procedures described in paragraphs 3.2. and 3.3., determine these temperatures and record them. Insert the sliding scale into the rule so that the side marked SLING/ASSMAN is visible. Set the arrow on the sliding scale to point to the dry bulb temperature on the bottom scale (dry bulb) of the rule. Keeping the sliding scale at this position, locate the wet bulb temperature on the top scale. If the wet bulb temperature is opposite a line on the sliding scale, follow the line and read the number (% relative humidity) at the bottom of the line (dashed lines represent 15, 25, 35, etc.). If the wet bulb temperature falls between two lines, estimate the relative humidity to the nearest whole number (68, 73, etc.). Record the % relative humidity in the notebook under "RH."

3.5. Estimation of Cloud Base Height. Cloud base height can be estimated by determining the difference between dry bulb and wet bulb thermometer readings with the sling psychrometer and multiplying this difference by 333. Water condenses when the air temperature reaches the dew point (wet bulb reading). Therefore, if the air temperature (ground or ambient temperature) is 72°F (dry bulb reading) and the wet bulb (dew point) temperature reads 65°F, the difference in temperature is 7°F. Under normal conditions (slow-moving low pressure systems, etc.) there is a temperature drop of 1°F for every 333 feet. In this case the height of the base of the clouds would be approximately 2331 feet (7 x 333). The closer the dew point temperature (wet bulb) approaches the ambient temperature (dry bulb), the lower the base of the clouds. When the dew point and ambient temperature are the same, the ceiling should be zero (fog) or 100% relative humidity.

3.6. Wind Speed. The wind speed is measured using the plastic wind meter. Before taking a reading make a check of the meter to insure that it is clean and dry and that the ball moves freely in the tube. To make a reading, face the wind and hold the wind meter in a vertical position with the scale facing the observer. Insure that the two holes at the bottom of the meter are not blocked. For wind speeds between 2 and 10 miles per hour, read the speed on the left-hand scale, which corresponds to the height of the ball. If the wind speed is such that the ball rises off the scale, place a finger over the hole at the top of the meter and read the speed on the right hand scale. Record the wind speed in the notebook under "WIND SP." Wind speed is often variable. Record variability as an observation and indicate the amount of variation.

3.7. Wind Direction. Wind direction is measured using the modified compass. Wind direction is the direction from which the wind is coming. When using this item, stand well away from metal objects that may affect the compass, and large objects (trees, structures, vehicles, etc.) which may interfere with the wind direction. Hold the compass level and point the arrow (printed on the base) into the wind. Keeping the arrow on the base into the wind, rotate the compass dial until the "N" on the dial is aligned with the red end of the compass needle. Check to insure that the cork and string are hanging freely and that the string is deflected in a direction directly opposite the arrow and line on the base. Read the wind direction from the compass dial indicated by "READ BEARING HERE." An alternate method is to line up the string deflection with the line on the base and make the reading on the compass dial. If this reading is less than 180^{o}, add 180 to the reading to get the wind direction. If the reading is more than 180^{o}, subtract 180 to get the wind

direction. If there is no string deflection and wind cannot be felt the wind speed is zero (0) and there is no wind direction. If there is little or no string deflection, but a slight breeze can be felt, wind speed is 0 to 2 miles per hour. In this case, if wind direction cannot be determined, record as for no wind. Wind direction is often variable. Record variability as an observation and indicate the amount of variation.

3.8. Rain Fall. Remove the red plastic lid and return it to the carrying case. Assemble the metal rods and screw the assembled standard onto the plastic base of the cylinder. Stick the assembled rain gauge into the ground to a depth that will hold the gauge in an upright position. Keep the gauge away from trees, fences, buildings, etc., which may block rain fall or cause extra rain to splash into the cylinder. Leave undisturbed for the period of time over which the measurement is desired. The amount of rain fall is indicated in inches by the graduations on the cylinder. Insure that all water drops on the inside walls of the rain gauge fall in with the rest of the water prior to reading. When reading amounts of rain fall less than one inch, remove the cylinder from its socket. Record amount of rain fall under "PRECIP." If the amount of rain fall is greater than the capacity of the cylinder over the time period desired, interim readings can be made at fixed intervals. At the end of the desired time period, the interim readings are totaled to obtain the desired reading. In this situation, care should be taken to thoroughly dry the inside of the cylinder after each reading.

3.9. Snow Fall. Snow fall is measured using the standard for the rain gauge (8 inches). Snow fall is entered under "PRECIP" with a special note in the "OBSERVATIONS" column that it is snow fall.

3.10. Barometric Pressure. The barometer/altimeter has been adjusted prior to shipment to give correct barometric pressure readings. However, readjustment may be necessary on receipt of the instrument or after long use. A small key is supplied with the instrument, and adjustment is made by inserting the key in the slot in the stem on top of the instrument and very carefully turning the key to bring the pointer to the desired pressure mark. The adjustment should be made by comparison with a barometer which has been recently calibrated or which is known to be correct. Occasional adjustment by comparison with a barometer in a National Weather Service Office is recommended. The instrument supplied is graduated in millibars and millimeters of mercury (barometric pressure) and in meters (altitude). Barometric pressure can be read directly from the dial of the instrument in millibars/mm of mercury. A table of millibar equivalents versus millimeters and inches of mercury is attached to one side of the writing board for ready reference.

3.11. Altitude Determination. The barometer/altimeter can be used to determine altitude as follows: The outer dial is rotated so the known elevation of the starting point falls beneath the pointer. Subsequent readings will then be the altitude of the observation location. If differences in elevation are desired as a direct read-out, the zero on the barometer/altimeter dial should be set beneath the pointer at the start of the survey. If a considerable temperature change occurs between points of observation involving a large change in elevation, a more precise altitude value may be obtained by adding 0.2% of the scale reading for each $1^{o}F$ above $50^{o}F$ for increase in temperature or subtracting a like amount for decrease in temperature between observation points. Normally, temperature variation

may be neglected since the correction often falls within the scale sensitivity and personal reading error on the altimeter when used as a reconnaissance instrument.

SECTION IV. MAINTENANCE

4.1. General. Maintenance of the Weather Data Collection Set consists primarily of visual inspection and cleaning.

4.2. Carrying Case. The case should be cleaned by brushing with a stiff brush. Accumulated dirt can be removed by washing the case in warm water with a mild soap.

4.3. Sling Psychrometer. A visual inspection should be made prior to use. The thermometers should be checked for cracks. Insure that the chain is secured to the handle of the body of the psychrometer. After use, wipe dry and clean with a soft cloth prior to returning the psychrometer to its case. The psychrometer should be protected from excessive heat and mechanical shock. If the gauze sleeve on the wet bulb thermometer is lost or becomes unravelled, it can be replaced using a piece of gauze compress. The gauze must be secured to the wet bulb using thread or similar material.

4.4. Thermometer. The thermometer should be kept in the metal case provided when not in use and cleaned as necessary after use.

4.5. Wind Velocity Meter. The meter should be kept clean and moisture free. Make a visual inspection for cracks and insure that the bail moves freely in the tube.

4.5.1. If moisture enters the meter, remove the bottom fitting and let the moisture evaporate. Use the chemically treated pipe cleaner to clean the indicating tube, removing any moisture remaining.

4.5.2. A static electricity charge may prevent the ball from moving freely in the tube. Use the treated pipe cleaner as in paragraph 4.4.1. to correct this.

4.5.3. Keep the high range calibration orifice clean and open with the nylon bristles provided. Do not use wire, pins, or drills which might enlarge the opening.

4.6. Wind Direction Indicator. The wind direction indicator should be protected from large magnetic forces. Wipe dry and clean with a soft cloth.

4.7. Rain Gauge. The gauge should be thoroughly dried after use and between readings. Assemble the standard carefully to avoid misreading.

4.8. Conversion Slide Rule. The slide rule should be kept away from excessive heat and wiped clean with a soft cloth.

4.9. Barometer/Altimeter. Except for occasional calibration and adjustment of the pointer by comparison with a standard barometer, no service or maintenance of the instrument is required. If dropped or otherwise damaged, it should be returned to LWL for repair.

SUITABILITY STATEMENT

_____(item) has been in use by Army elements in _____(geographic area) since _____(date). Analysis of performance since that time indicates that:

1. It (is/is not) safe in operation.

2. Its reliability (is/is not) acceptable to this command.

3. Its maintainability (is/is not) acceptable to this command.

4. It requires (only normal/special) support provisions.

5. Technical risk connected with the continued fielding of this item is (low/moderate/high).

6. _____(item) is acceptable to this Command for operational use. It (satisfies/does not satisfy) all requirements of this Command. Based upon its performance in this operational environment, this item (should/should not) be considered for adoption Army-wide. Recommend type classification as _____.

_____
(Signed by a General Officer)

APPENDIX A1

PROPOSED EVALUATION PLAN
WEATHER DATA COLLECTION SET

1. References:

a. AR 115-10, Meteorological Support for the U. S. Army, 9 June 1970.

b. AR 115-12, U. S. Army Requirements for Weather Service Support, 12 February 1970.

c. Field Manual 31-3, Weather Support for Field Army Tactical Operations, 4 December 1969.

d. Trip Report, USALWL Liaison Team to USAREUR, 22 March 1972.

e. Letter, AHENG, Headquarters, USA Institute for Military Assistance, 21 March 1973, subject: Request for LWL Weather Kits.

2. Introduction: The Weather Data Collection Set is a simple, lightweight set which provides the capability to measure ambient temperature, relative humidity, dew point, atmospheric pressure, wind speed and direction, and amount of precipitation.

3. Background:

a. The Problem Solved and the Method. Tactical units require knowledge of current and projected weather conditions in planning and conducting operations. The USAF Air Weather Service requires periodic reports of local weather conditions as input for weather forecasting. The Weather Data Collection Set provides a simple, lightweight capability for use by personnel who are not trained meteorological observers. This set is intended to supplement, not replace, the more sophisticated equipment available or scheduled for issue to artillery and aviation units.

b. History.

(1) During a USALWL liaison trip to USAREUR in 1972, personnel from the 2d Armored Cavalry Regiment referred to a requirement placed on that unit to report weather observations and stated that the unit did not have the equipment needed to perform this task. In response to this problem, the USALWL assembled ten sets of equipment and delivered them to the 2d ACR for evaluation.

(2) During a USALWL liaison trip to USARAL, personnel referred to a similar weather data collection requirement and expressed an interest in the existing LWL set.

(3) The USA Institute for Military Assistance has stated a desire for a Special Forces evaluation.

c. Testing Performed to Date.

(1) The psychrometer, wind speed meter, and conversion slide rule are either available commercially or through the Federal Supply Catalog. These items have been inspected for completeness and tested for proper operation. The rain gauge was fabricated at LWL and calibrated for accuracy with a standard rain gauge. The wind direction indicator is a modified commercial compass and has been tested for proper operation. Climatic and other tests have not been performed by this Laboratory.

(2) The parachute-delivery capability of this item has been tested by USALWL. The equipment is considered suitable for parachute delivery when properly packed in an aviator's kit bag, rucksack, parachutist's adjustable equipment bag, or individual weapons and equipment container.

4. Description of Materiel:

a. The Weather Data Collection Set provides the user with the capability of measuring the following weather parameters:

(1) Relative humidity (Over a range from $+30^{\circ}F$ to $+120^{\circ}F$ with the sling psychrometer).

(2) Dew point.

(3) Ambient temperature (from $-25^{\circ}F$ to $+120^{\circ}F \pm .5^{\circ}$).

(4) Atmospheric pressure ($\pm$ .5 mb).

(5) Wind speed (0 to 60 mph $\pm$ 2 mph).

(6) Wind direction ($360^{\circ} \pm 5^{\circ}$).

(7) Amount of precipitation.
(a) Rain - 3.5 inches $\pm$ .1 inch.
(b) Snow - 8 inches using base of rain gauge.

(8) Estimation of cloud base height.

b. The set includes the following components:

(1) Carrying case.

(2) Sling psychrometer.

(3) Thermometer

(4) Barometer/altimeter.

(5) Compass and wind direction indicator.

(6) Wind speed meter.

(7) Conversion slide rule (relative humidity).

(8) Rain gauge.

(9) Weather data notebook.

(10) Water vial.

(11) Writing board.

(12) Instruction manual.

(13) Pens.

5. Description of Operation: See attached instruction manual (Incl 1).

6. Purpose of Proposed Evaluation: The purpose of this evaluation is to determine if this item is ready for production in operational quantities or if not suitable, specifically to identify the shortcomings which make it unsuitable. An additional purpose is to provide the basis for a Required Operational Capability document.

7. Time Schedule: The following time schedule is recommended to provide the basis for planning by the evaluating command.

a. Training. Approximately 1/2 day training in the operation and maintenance of the equipment is considered sufficient to familiarize the operators with the correct procedures.

b. Operation. The set should be evaluated under field conditions. The evaluation period should include sufficient field exercises to address the points referred to in paragraph 8 below.

8. Procedure: It is recommended that the following procedures and subject areas be included in the unit evaluation to insure that the key questions pertaining to the set are addressed.

a. Evaluation Setting. As the Weather Data Collection Set is intended for making weather observations under field conditions, the evaluation should be conducted during field training exercises.

b. Observations and Reports. Weather observations should be made and processed in accordance with the unit SOP. If this is not covered by SOP, it is recommended that procedures be established to make observations at certain times throughout the day and report these observations according to a definite schedule.

c. Weather Parameters. The capabilities listed in paragraph 4 are those basic parameters considered suitable for measuring with this set. The evaluation should include consideration of adding or deleting capabilities and the adequacy of the ranges of each of the capabilities provided.

d. Training Requirements. The requirements for training personnel to use the set accurately should be considered and commented on in the evaluation report.

e. Packaging. The capability of the components to withstand field use is important. This includes parachute delivery.

f. Instruction Manual. This set was designed so that personnel can use it following a minimum of training. The instruction manual is intended to serve as a basis for the training that is required. Its adequacy should be a subject for comment.

9. Training: The instruction manual provided can be used as the basis for training personnel to operate the equipment. It is estimated that this training can be completed in less than four hours. (It is proposed that the USALWL Project Engineer will accompany the set to assist in training unit personnel, Fort Bragg evaluation only.)

10. Support Requirements:

a. Troop Support. The set should be issued on the basis of one per company (infantry battalion) and one per A detachment or B detachment (Special Forces Unit).

b. Technical Support The USALWL will provide technical assistance on request of the evaluating unit.

11. Safety: This set is considered safe for operational use.

12. Reporting Procedure: The results of any evaluation conducted on a USALWL prototype are of critical importance to the mission of this Laboratory. These results are used to determine what further development is needed and serve as a basis for a proposed Required Operational Capability and subsequent action to include the item in the US Army inventory. Accordingly, it is requested that, at the completion of the evaluation, a summary report with attached questionnaires (see Incl 2) and suitability statement be forwarded to the Commander, USA Land Warfare Laboratory. The report should include a statement of the conditions under which the evaluation was conducted and the specific points disclosed during the evaluation. A suggested format for the suitability statement is attached as Incl 3.

13. Disposition of Items: It is requested that damaged or otherwise inoperable items be returned to USALWL.

14. Miscellaneous: Questions pertaining to the Weather Data Collection Set and this evaluation plan should be addressed to Mr. M. J. Wargovich, USA Land Warfare Laboratory, Aberdeen Proving Ground, MD 21005 (Autovon 870-4204/3963).

4 Incls
1. Instruction Manual
2. Questionnaire
3. Suitability Statement

APPENDIX A2

EVALUATION OF THE USALWL WEATHER KIT
QUESTIONNAIRE

The following information is requested so the USALWL Weather Kit can be evaluated and improved. Your effort is appreciated.

Military Unit (Troop/Battery) _____

MOS _____ Rank/Grade _____

Evaluation Time Period (Month) _____

I. General Information.

A. Operational condition under which evaluation was conducted:

Garrison _____ Field _____ Other (specify) _____

B. Data on use of kits:

1. Maximum number of tests performed: a) Per day _____

b) Per operation _____

c) How many times per day required to obtain meteorological data?

_____

2. Average time required to perform one complete cycle _____

II. Performance.

A. Is instruction manual adequate? _____

If not, indicate shortcomings _____

_____

_____

_____

B. Use of kit.

1. Manipulations required to utilize equipment:

a) Is equipment reasonably accessible? _____

b) Is the kit practical and easy to use in all test situations?

_____

c) Impractical or difficult in one or more test situations?

_____

d) If c (above) is checked, explain briefly: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

2. Reading equipment:

a) Practical and easy in all test situations _____

b) Impractical or difficult in one or more test situations

_____

c) If b (above) is checked, explain briefly _____

_____

3. Kit effectiveness:

a) Does the kit provide basic essential meteorological data in all test situations?

b) If answer to a (above) is no, explain briefly

C. Specific deficiencies, shortcomings or problems in use of the kit. List and explain briefly.

D. Miscellaneous remarks:

1. Total number of tests performed using this kit _____

2. Indicate your estimate of overall suitability and effectiveness of this kit.

APPENDIX B

Evaluation of Weather Kit, USALWL Task No. 08-S-72
HQ 2nd Armored Cavalry Regiment

APPENDIX B

AETSAC-AI 27 Mar 73 2d Ind.
SUBJECT: Evaluation of Weather Kit, USALWL Task No. 08-SA-72

DA, HEADQUARTERS 2D ARMORED CAVALRY REGIMENT, APO 09093 8 May 73

THRU: Commander In Chief, USAREUR, ATTN: ODCSOPS (AEAGC-ND), APO 09403

TO: Department of the Army, U.S. Army Land Warfare Laboratory
Aberdeen Proving Ground, Maryland 21005

1. Weather observations are required to support 2d Armored Cavalry Regiment (2ACR) air operations along the international borders of the Federal Republic of Germany, East Germany and Czechoslovakia.

2. The observations are used by the USAF weather detachment which supports the 2ACR. These observations augment data received from German civilian meteorological stations and also fill in areas where there are no nearby observing stations. The limited observations, added to other weather information is used to provide weather briefings to aircrews of the U.S. Army which patrol the West German international border.

3. The observations are telephoned directly from the border camps to the weather detachment located at Feucht AAF, West Germany. These observations are then transmitted on a teletype circuit by the USAF weather detachment for use by other weather stations and the USAREUR Forecast Center.

4. Observations are made hourly from 0600A to 1500A, 7 days a week.

5. The area covered includes 625 kilometers of mountenous and hilly terrain along the international borders of the Federal Republic of Germany, East Germany and Czechoslovakia.

6. The LWL weather kits are usefull and suitable overall. There are a few minor discrepencies with the component parts. The more important ones follow:

a. The thermometers on the sling psychrometer are not suitable. The thermometers were received with a temperature range of plus 30°F to 110°F which in this climate is not low enough for actual temperatures. LWL was notified as to this short coming and replacement thermometers were sent. This did not solve the problem although the temperature range was correct (minus 38°F to plus 130°F), you just can not mount a 10½ inch long thermometer in a sling that was designed for one 4½ inches long.

b. The notebook is also not adequate for the type of observations taken. We need something to give the observer the ability to record observations in support of aircraft operations.

c. The LWL kit includes no equipment to measure the hight of cloud bases above the surface of the ground. Without a cloud base measurement the observation is left lacking in the most important area of aircraft operations.

7. With the inclusion in the kit of proper thermometers, a better form to record the observation, and most important some type of equipment to measure cloud bases, the LWL kit will be very usefull and suitable for this mission. We would just like to make certain that the Land War Laboratory is fully aware that these observations are used mainly in support of air operations and not ground operations.

FOR THE COMMANDER:

1LT, ASST ADJ

for GEORGE R. SHIELDS
CPT ARMOR
Adjutant

APPENDIX C

Lightweight Weather Data Collection Kit
USMC Development and Education Command

10 B-73

APPENDIX C

DEPARTMENT OF THE NAVY
UNITED STATES MARINE CORPS LIAISON OFFICE
U. S. ARMY TEST AND EVALUATION COMMAND
ABERDEEN PROVING GROUND, MARYLAND 21005

STEAP-MC
12-024
11 December 1973

From: Marine Corps Liaison Officer, U. S. Army Test and Evaluation Command, Aberdeen Proving Ground, Maryland 21005
To: Commander, Land Warfare Laboratory, Aberdeen Proving Ground, Maryland 21005

Subj: Lightweight Weather Data Collection Kit

Encl: (1) Chief, Air Operations Division ltr, subj as above, dtd 10 Dec 73

1. In April of this year a Lightweight Weather Data Collection Kit designed by the Land Warfare Laboratory was sent to the Development Center, Marine Corps Development and Education Command, Quantico, Virginia. The cover letter requested an evaluation of the kit regarding its applicability to Marine Corps needs.

2. Enclosure (1) provides a limited evaluation of the subject kit. It is unfortunate that there was no opportunity to test the kit in actual field exercises; however, it appears that the weather data collection equipment would be of value for special missions.

3. In the event that there are any additional items that the Land Warfare Laboratory desires to have considered or evaluated by the Marine Corps, I will be glad to deliver them to the project officers assigned to the specific area of interest.

William J. P. Mannix

WILLIAM J. P. MANNIX
Major, USMC

OPNAV 5216/144 (REV. 6-70)
S/N-0107-778-8099

DEPARTMENT OF THE NAVY

Memorandum

D 04-1/SHC:dew
DATE: 10 Dec 1973

FROM Chief, Air Operations Division

TO Marine Corps Liaison Officer, U. S. Army Test and Evaluation Command, Aberdeen Proving Ground, Maryland 21005

SUBJ Lightweight Weather Data Collection Kit

Ref: (a) Your letter STEAP-MC 4-048 of 16 Apr 73

1. In response to Reference (a), the subject kit was given a limited evaluation by the Air Operations, Ground Operations, and Intelligence Divisions. No opportunity for field tests has arisen since receipt.

2. The following comments are offered:

(a) There is no stated Marine Corps requirement for the kit, although several scenarios could be postulated in which it could be useful.

(b) Individual components of the kit appear to be rugged enough to last, with reasonable care, through the period of intended use. Experience of personnel there with the wind velocity meter, for instance, bought as a commercial item for a project two years ago, was that the accuracy in the 2-10 mph range was ± 2 mph, which is considered good.

(c) The kit would appear to have value and utility to an isolated unit/person, such as a coast-watcher, or deep observation post.

3. We appreciate the opportunity afforded to evaluate the kit.

S. H. CARPENTER

Copy to:
Gnd Ops
Intell

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Commander 1
MASSTER
ATTN: Combat Service Support & Special Programs Directorate
Fort Hood, TX 76544

Commander 2
US MAC-T & JUSMAG-T
ATTN: MACTRD
APO San Francisco 96346

Senior Standardization Representative 1
US Army Standardization Group, Australia
c/o American Embassy
APO San Francisco 96404

Senior Standardization Representative 1
US Army Standardization Group, UK
Box 65
FPO New York 09510

Senior Standardization Representative 1
US Army Standardization Group, Canada
Canadian Forces Headquarters
Ottawa, Canada K1A0K2

Director 1
Air University Library
ATTN: AUL3T-64-572
Maxwell Air Force Base, AL 36112

Battelle Memorial Institute 1
Tactical Technical Center
Columbus Laboratories
505 King Avenue
Columbus, OH 43201

Defense Documentation Center (ASTIA) 12
Cameron Station
Alexandria, VA 22314

Commander 2
Aberdeen Proving Ground
ATTN: STEAP-TL
Aberdeen Proving Ground, MD 21005

Commander 1
US Army Edgewood Arsenal
ATTN: SMUEA-TS-L
Aberdeen Proving Ground, MD 21010

US Marine Corps Liaison Officer 1
Aberdeen Proving Ground, MD 21005

Director 1
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US Army Electronics Command
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Fort Belvoir, VA 22060

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San Antonio, TX 78243

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Rock Island, IL 61201

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ATTN: Max Hamlin
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